change of form in Yaruro society would be expected. Changes could occur only by virtue of a changed technology derived either from internal developments or diffusion. 182

It is justified to assert, I believe, that, given the technological and ecological conditions of the Yaruro, internal developments of an evolutionary sort would be unlikely, or, at best, exceedingly slow. It seems to the writer, that the nature of the wet and dry savana soils at least in the Cinaruco area precludes any possibility of cropping by means of slash-and-burn horticulture, or even, to any extent, by modern agricultural means. Therefore development would have been restricted to improvements in the existing technology such as the domestication of new plants or the improvement of old ones grown in the restricted areas along the streams. Maximum surpluses would still have been restricted, and the singular ecological relations of this region would nevertheless have been maintained. Improved fishing techniques might have increased output - the weir, the trap, poisons (used by some groups of Yaruro), nets and seines. fish pools would have increased the fish intake, but there are no salmon runs or the like, here, so that a maximum would soon have been reached in fishing too. 000

Of introduced food plants and animals, the same may be said, unless some plant growing with notable success in the dry sandy savana soils had appeared. However, no such plant was available from any surrounding source and still is not. It is doubtful whether techniques of fertilization could either have been internally evolved or brought in from other peoples which would have made a significant difference to production. In fact, even with a modern agronomical technology, as well as better soils than possessed by either the Cinaruco or Capanaparo Yaruro, the problem of fertilization of their savana lands has not been solved even by contemporary Venezuelans. Had it been possible to develop any form of fertilizer under native conditions, the best that might have occurred would have been to raise the swidden productivity somewhat, thus raising the population. But it is doubtful if it would have significantly changed the forms of surplus, the ecology, or social structure. Conceivably, however, villages might have become larger and more fixed and ranking somewhat more marked.

Among the Yaruro, water control would have been impossible, because the small streams, and even the larger caños, dry up in summer altogether while the rivers are reduced to relative trickles. Any significant irrigation system would have had to have been on such a scale as only a major state could undertake a state of greater proportions and wealth than contemporary Venezuela for example. Even had such been possible, it is doubtfult whether irrigation would have helped the sandy savanas of the Cinaruco, so heavily leached by rain, though water control might well permit a large increase in agricultural productivity in the loamier parts of the llanos. Thus, a major agricultural technique known to relatively near neighbors of the Yaruro was for ecological and social reasons not diffusable.

Finally, warfare, which might have elicited a more hierarchical form of social organization, had not evolved as a Yaruro culture trait. In the 182 72

182 72 first place, the ecological conditions to the north, west, and south were, if anything, more severe than their own, so that there was little advantage to gain by warring in these areas. To the east were the Orinoco highlands, mountainous and heavily wooded country, an ecology quite different from, and probably as difficult as, their own.

182 We may conclude then, that, with the given technology, and under the given ecological conditions peculiar to the Yaruro region, the possibility of evolving to a more advanced tropical forest type like the Kuikuru, or even the Carajá, who in a number of ecological respects are like the Yaruro, was extremely limited. Second, there was little possibility of circumventing this development by directly taking on Circum-Caribbean traits from nearby groups. The Yaruro had to remain, under native systems of [177] subsistence, which did not include the European-derived cattle herding now found in the llanos, at a fixed level of technology, with a fixed ecology, and hence with a fixed form of social structure. Only the recent exposure to cattle herding is breaking up the fundamental form of their economy.

Under any conceivable native conditions, the basic ecological relationships and forms would have had to remain essentially unchanged. We may therefore deduce that the concomitant socio-cultural structure would have had to remain unchanged. Yaruro society was, for ecological reasons, substantially at an evolutionary dead end.

000 With this view of Yaruro ecology and cultural development, we may turn to the question of what conditions of incipient tropical forest horticulture might have provided a foundation for evolution to a higher level. The inhibition of Yaruro development is a result of certain specific ecological limitations. Consequently, where those limitations do not exist or could be removed, one would find, other factors being equal, conditions under which incipient horticultural groups would evolve to higher levels of organization.

Holding technology constant, a much greater per cent of tillable to total land, say up to 50% [21] instead of 0.5%, would allow for an enormous increase in population - up to a hypothetical 12,500-15,000 [22] - which would permit or rather demand, a more elaborate social organization. A marked seasonal fluctuation in the productivity of these lands, that is, in the production of surpluses, would provide a situation in which forms of stratification could appear. A proportionally greater dependence on these food resources requiring intensive labor in order to maximize yield per acre, as in the case of corn or yams, would provide the basis for more elaborate socio-political organization. Thus, manioc which produces the largest tubers in relatively *poorer*, weakly nitrogenous, soils, requires much less effort to produce the several millions of calories per acre mentioned above than do corn and yams in better soils in order to push their productivity up to the maximum half-million calories per acre. Corn and yams appear to produce more with intensive care such as hilling and weeding, as well as the use of bird-watchers, and the like, as the papers on both the Taino and the Sub-Andean which follow clearly indicate. Where manioc will not conveniently grow

[21, 22 [for footnotes see p. 44, category 116-- Analyst]